Consequences of the Production of Very Massive Magnetically Charged Leptons Early in the Universe and Their Decays to a New Set of Extremely Massive Neutrinos

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We examine the production and decay of extremely heavy magnetically charged leptons,(τ_g and μ_g), to their own very heavy μ_g and e_g plus their own new species of neutrinos, ν_g and $\bar{\nu}_g$, at some time early in the universe which could be present in space and, attracted gravitationally towards and passing through astronomical objects, annihilated with each other to produce large numbers of photons. Further, we describe the possibility of presently detecting the bursts of such photons, of three different total energies, in the seas or oceans on earth.

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A century has passed since the idea of the existence of magnetic charges was introduced by modifying the equations of electromagnetism so that $divB$ was not equal to zero but replaced by $divB = \rho_g$ in analogy with $divE = \rho_e$. Indeed in 1904 it was shown [1] that for a monopole g at rest, separated from an ordinary charge e at rest, that there was an angular momentum in the field given by $\vec{l} = ge\ \vec{r}_1$. In 1931 it was this angular momentum that P.A M. Dirac quantized [2] which then required that, while the fine structure constant, $e^2/\hbar c$, was 1/137, the similar constant, $g^2/\hbar c$, was huge and equal at least to 137. In 1976 [3] it was realized that the symmetry requirement that electromagnetism must conserve parity (P) and be time reversal invariant (T) allowed one to derive the above results without any use of Maxwell's Equations.

Now, decades later, we know of the existence of the three electrically charged leptons tau, mu, and e. Indeed, because the fine structure constant is so small, one can actually calculate the exact masses of electrically charged leptons, tau and mu. Unfortunately, because $g^2/\hbar c$ is so large, one cannot calculate the magnetic lepton masses. For many decades, as accelerator energies have increased, searches for "monopoles", as they are often called, have continued and most recently this journal has again reported the failure to find them at the present high energies available in the Fermilab collider [4].

There does not appear to be any reason that the hierarchy of magnetically charged particles should be any different from the hierarchy of the known electrically charged particles, but this note will not address the interesting questions of magnetically charged W's, other than to remark that they must exist.

The first prediction is that the magnetic leptons, the τ_g and μ_g, will decay to their e_g by the same reaction found for ordinary electrically charged tau's and mu's that decay to the neutrinos that have been observed. However, this will result in the creation of a new set of magnetic neutrinos much heavier than the neutrinos from ordinary tau and mu decays which we now know to have extremely small masses, not equal to zero. The ordinary (electric origin) neutrinos that have been measured till now are often called "massive neutrinos" and a complete review of their properties can be found in reference [5]. Perhaps, to stress the distinction, they should be called light neutrinos.)

We now turn to the interesting properties of the new neutrinos that are involved in the decays of magnetically charged tau's and mu's:

1. They do not interact at all with the protons, neutrons and electrons that make up our universe. Only ordinary neutrinos can do so. (This would not be the case in a universe made up of anti-matter.)

2. They have mass so they are attracted to massive bodies like the earth, but they simply pass on through, making no interactions with anything.

3. However, there are occasions when a magnetic neutrino comes within range of a magnetic antineutrino. The result would be a burst of photons with three different energies depending on whether the neutrinos are associated with the different mass magnetic leptons, tau, mu, or e.

4. It is perhaps worth noting that the same Feynman diagram used to describe the annihilation of ordinary neutrinos and their antineutrinos into photons would be used but with a new magnetically charged W as the intermediate state.

The bursts of photons coming from the magnetic origin proposed neutrino annihilations should be examined by astrophysicists since they should have affected the expansion of the universe.

We next examine the possibility of an experiment on earth that might possibly actually measure the photons from the annihilations of magnetic origin neutrinos. Experiments in mines have the property that the neutrinos

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would be attracted into the mine walls and, if they annihilate within, the photons would be absorbed and not enter the detectors. However experiments in seas and oceans would not have this problem. In particular there is the experiment called NESTOR that has its laboratory on the shores of the Ionian Sea at Pylos. Having a large number of layers of detectors in large rings that go miles deep into the Sea, and not surrounded by walls, it would be a place to search for the photon bursts since it is designed, among other things, to detect photons [6].

Searches for monopoles and massive exotic particles have been of great interest and the reader might want to browse the reports of various collaborations: The MACRO collaboration, "Search for GUT Monopoles and massive Exotic Particles"; Antares Collaboration, "Neutrino Telescopes as Magnetic Monopole Detectors"; Inst. For Nuclear Research of RAS, Moscow, "Detection of Relativistic Magnetic Monopoles".

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